Claims

The claims defining this invention are as follows:

1. A method of fabricating a cleaved facet of a laser device, said device having a substrate and at least one GaN-based layer formed upon a first surface of the substrate, said method including the following steps:

   - cutting linear grooves into a second surface of the substrate, said grooves being in alignment with vertical planes of said substrate; and
   - cleaving said substrate and said at least one GaN-based layer along said vertical planes;

   wherein said cutting is effected by a laser beam from an external laser source.

2. A method according to claim 1, wherein the substrate is formed of sapphire.

3. A method according to claim 2, wherein the sapphire substrate is formed of c-plane sapphire.

4. A method according to any one of claims 1 to 3, wherein the vertical planes are selected from one or more of the m-planes (1100) and the a-planes (1120).

5. A method according to claim 4, wherein the vertical planes are the a-planes (1120).

6. A method according to any one of claims 2 to 5, wherein the thickness of the substrate is less than about 400 μm.

7. A method according to claim 6, wherein the thickness of the substrate is between about 350 μm and about 400 μm.

8. A method according to claim 6 or claim 7, wherein the grooves are cut to a depth of from about 40 μm to about 100 μm.

9. A method according to claim 8, wherein the grooves are cut to a depth of from about 50 μm to about 80 μm.

10. A method according to claim 8 or claim 9, wherein the depth of said grooves is controlled by process parameters including the intensity of the laser beam, the speed at which the laser beam is scanned over the grooves and the number of times the laser beam is scanned over said grooves.

11. A method according to claim 10, wherein the laser beam was focused on the second surface of the substrate within a radius of from about 20 μm to about 30 μm at $1/e^2$ density.

12. A method according to claim 10 or claim 11, wherein the average power of the laser beam is about 1.4W.

13. A method according to any one of claims 10 to 12, wherein the repetition rate of the laser beam is from about 2 kHz to about 5 kHz.

14. A method according to any one of claims 10 to 13, wherein the pulse width of the laser beam is from about 5 ns to about 30 ns.

15. A method according to any of claims 10 to 14, wherein the laser beam is scanned over the second surface of the substrate from 2 to about 12 times at a velocity of about 1 mm/sec.

16. A method according to any one of claims 1 to 15, wherein the at least one GaN-based layer includes a plurality of GaN-based layers.

17. A method according to claim 16, wherein the plurality of GaN-based layers include GaN/InGaN/AlGaN layers.

18. A method according to claim 16 or claim 17, wherein the GaN-based layers are formed using epitaxial lateral overgrowth (ELOG) techniques.

19. A laser device having cleaved facets formed according to the method of any one of claims 1 to 18.